

## Summary

This *Non-Native Deer Management Plan Environmental Impact Statement* analyzes options for the management of non-native axis and fallow deer at Point Reyes National Seashore (PRNS) and the PRNS-administered lands of Golden Gate National Recreation Area (GGNRA), together referred to hereafter as the “Seashore”, “Park” or “PRNS.” The preferred alternative is the removal of all individuals of these exotic species through a combination of shooting and contraception.

## Need for Action

The impacts of non-native deer on the native ecosystem in the park and regulatory policies indicate the reduction or elimination of these species is needed. The alternatives analyzed in this EIS investigate the degree of removal required and the means to do so.

In the NPS *Management Policies 2001*, the National Park Service instructs parks such as Point Reyes National Seashore to “re-establish natural functions and processes in human-disturbed components of natural systems (sec 4.1.5).” This same section includes non-native (also called “exotic” or “alien”) species as an example of a human-caused disturbance that can have severe impacts on natural biota and ecosystems.

Parks are specifically mandated to control exotic species “up to and including eradication” of a population if that species does not meet an identified park purpose and if such control is “prudent and feasible.” Only through the removal of exotics and other changes resulting from human disturbance can the NPS return its park units to the most natural condition possible and meet its mandate to preserve them in this condition for future generations.

The presence of non-native axis and fallow deer is both the result of human activities and disruptive to many elements of the natural ecosystem at PRNS. Some of the more serious effects these non-native deer have at the Seashore include competition with and displacement of native tule elk and black-tailed deer (particularly in high deer density or low forage conditions), the potential for transmitting disease to these native deer, heavy use of and resulting direct impacts to riparian and woodland habitats and indirect impacts to the native wildlife dependent on this habitat. Fallow deer have been documented to cause denudation of major areas of woodland and riparian areas during the breeding season (Fellers and Osbourn 2006). They have also been shown to cause trailing, girdling of young trees and trampling of riparian vegetation. Both axis and fallow deer browse shrubs when grasses are not available and consume the same plant species as native deer and elk (Elliott 1983, Elliott and Barrett 1985, Fellers 2006; Fallon-McKnight 2006). Loss of riparian habitat can affect a number of species at PRNS, including several special status species, such as California red-legged frog, Coho and Chinook salmon and steelhead trout. Fallow and axis deer also affect Seashore ranchers by damaging fences and through depredation of livestock pastures and supplemental livestock feed.

Populations of both species of deer have increased in recent years and the range of fallow deer appears to be expanding eastward, towards and beyond Seashore boundaries. This population and range expansion, if allowed to continue, could mean these same types of impacts would occur on private and public lands outside PRNS. Currently, the population of axis deer and fallow deer are about 250 and 860, respectively.

## Purpose and Objectives

The purpose of this management plan is to define management prescriptions for non-native deer management. Both the park's General Management Plan (GMP) and Resource Management Plan, identify goals for management of these exotic species. The park Resource Management Plan (NPS 1999) indicates that: "Regardless of potential competition and disease issues, the presence of these non-native deer compromises the ecological integrity of the Seashore and the attempts to reestablish the native cervid fauna comprising tule elk and black-tailed deer" and notes that three scientific panels comprised of federal, state, and university researchers and managers recommended the removal of non-native deer to promote native deer and elk.

The objectives of the plan are:

- To correct past and ongoing disturbances to Seashore ecosystems from introduced non-native deer and thereby to contribute substantially to the restoration of naturally functioning native ecosystems.
- To minimize long-term impacts, in terms of reduced staff time and resources, to resource protection programs at the Seashore, incurred by continued monitoring and management of non-native deer.
- To prevent spread of populations of both species of non-native deer beyond Seashore and GGNRA boundaries.
- To reduce impacts of non-native deer to agricultural permittees within pastoral areas through direct consumption of forage, transmission of disease to livestock and damage to fencing.

## Alternatives

The following five alternatives, including the preferred alternative (Alternative E), were created by reviewing public comments, consulting with NPS personnel, and by reviewing relevant literature. Public input consisted of verbal comments made during a public meeting in Point Reyes Station on May 4, 2002, and letters and emails from the public, sent to the superintendent during the scoping period of May 4 to July 5, 2002. In addition, after the notice of availability of the draft EIS was published in the *Federal Register* on February 4, 2005, the Seashore received approximately 1,650 letters and emailed comments during the subsequent 63-day comment period, which ended April 8, 2005. A public informational meeting on the plan was held on March 3, 2005, at the Red Barn Conference Room, in the Seashore. An Exotic Deer Interdisciplinary Team, made up of PRNS staff from several divisions, and the Environmental Quality Division of the NPS (Biological Resource Management Division) reviewed all submitted comments. The Interdisciplinary Team considered all scoping comments, as well as pertinent literature, laws, policies and NPS mandates in formulating the alternatives. It also reviewed comments on the range of alternatives or on specific alternatives themselves made during the review of the draft EIS, and has responded to them (along with all other substantive comments) in Chapter 5 of this final EIS.

### Alternative A: No Action

No non-native deer control actions would be undertaken. Monitoring activities would continue for the life of the Plan.

### **Alternative B: Control of Non-Native Deer at Pre-Determined Levels by Agency Removal**

Non-native deer populations would be controlled initially to a level of 350 for each species (700 total axis and fallow deer). Control of each non-native deer species to 350 animals would be accomplished with lethal removal by NPS staff or contractors specifically trained in wildlife sharpshooting. Efforts would be made to reach target levels in 15 years, to ensure continued presence of both species in the Seashore, and to reduce risks of range expansion beyond Seashore boundaries. This would entail removing between 150 and 250 deer per year for the first ten years with harvest numbers decreasing to 100-150 deer per year from 2016 on. The total number of deer that would require removal is unknown (infinite). Where axis and fallow deer carcasses could be moved, they would be donated to charitable organizations as food for the needy or for endangered species recovery programs. In cases where carcasses could not be accessed, they would be left in place to recycle nutrients into the ecosystem. Monitoring activities would continue for the life of the Plan.

### **Alternative C: Control of Non-Native Deer at Pre-Determined Levels by Agency Removal and Fertility Control**

Non-native deer populations would be controlled initially to a level of 350 for each species (700 total axis and fallow deer) using both lethal removal and fertility control. Efforts would be made to reach target levels in 15 years.

The contraceptive program would incorporate the latest contraceptive technologies to safely prevent reproduction, for as long as possible, and with minimal treatments per animal. Because no long-acting “sterilant” has been registered for use in wildlife by the Environmental Protection Agency, studies on safe and efficacious use of a candidate drug would have to be conducted at PRNS.

Population modeling for fallow deer at PRNS suggests that, in this alternative, total numbers of non-native deer removed by 2050 would be at least 3,000 (2,200 axis and 800 fallow deer). Fallow deer would be treated with an experimental long-acting contraceptive that shows promise for multi-year effectiveness in this species. No agents show the same promise for axis deer, but should such contraceptive technology become available, its practicality and effectiveness would be tested on axis deer as well. Total numbers of fallow does treated by 2050 with a lifetime contraceptive, should one exist, would vary depending on overall sex ratios and density dependent factors but could range from 200 to 300. Because the effectiveness of long-term contraceptives on axis deer is unknown, similar models have not been developed for this species.

Because the goal of this alternative would be to control axis and fallow deer at a specified level and not to eradicate them from PRNS, annual culling and fertility control would continue indefinitely and total numbers of deer removed and treated with contraceptives is unknown (infinite). Monitoring activities would continue for the life of the Plan.

### **Alternative D: Removal of All Non-Native Deer by Agency Personnel**

In Alternative D, all axis and fallow deer inhabiting the Seashore and the GGNRA lands administered by the Seashore would be removed by 2021 through lethal removal by NPS staff or NPS contactors specifically trained in wildlife sharpshooting. This would entail culling approximately 250 non-native deer per year. Total numbers of non-native deer removed could range from 1,400 to 2,200 depending on starting population size and structure, composition and type of deer removed early in the program, and herd growth rates. Where deer carcasses could be moved, they would be donated to charitable organizations as food for the needy or for endangered species recovery programs. In cases where carcasses could not be accessed, they would be left in place to recycle nutrients into the ecosystem. Monitoring activities would continue until all non-native deer were removed, by 2021.

### **Alternative E (Preferred Alternative): Removal of All Non-Native Deer by a Combination of Agency Removal and Fertility Control**

In Alternative E, all axis and fallow deer inhabiting the Seashore and the GGNRA lands administered by the Seashore would be removed by 2021 through lethal removal and fertility control. Culling would be conducted by NPS staff or NPS contactors specifically trained in wildlife sharpshooting.

As in Alternative C, a percentage of fallow deer females would be treated with an experimental long-acting contraceptive, and both axis and fallow deer would be removed via shooting. Should such contraceptive technology become available for axis deer, its practicality and effectiveness would be tested on females of this species as well.

Population modeling for fallow deer at PRNS suggests that, in this alternative, total numbers of both species of non-native deer removed by 2021 are projected to be at least 1,350 (800 axis and 550 fallow deer) while total numbers of fallow does treated by 2021 with a lifetime contraceptive, should one exist, could range from 100 to 150.

Where deer carcasses could be moved, they would be donated to charitable organizations as food for the needy or for endangered species recovery programs. In cases where carcasses could not be accessed, they would be left in place to recycle nutrients into the ecosystem. Monitoring activities would continue until all non-native deer are removed, by 2021.

A number of issues, raised by the public during scoping, are beyond the scope and direction of this document. Some are discussed as they relate specifically to non-native deer (i.e., impacts to native deer or livestock of the various alternatives), while other topics are addressed in other NPS planning documents.

Several alternatives were considered by the NPS or proposed by the public but rejected because they are beyond the document's scope, are technically or economically infeasible, are outside laws, regulations and policies that govern the park or are unable to meet park objectives. These include:

- Managing native deer at PRNS
- Managing non-native deer outside of NPS boundaries
- Managing livestock at PRNS
- Public hunting of non-native deer

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- Yearly contraception
- Use of long-acting contraceptives (“sterilants”) alone
- Surgical sterilization
- Relocation
- Restricting deer to a fenced area
- Trapping and euthanasia by lethal injection

Alternatives D and E were identified as environmentally preferable and Alternative E is the park’s preferred alternative at this time.

### **Impacts**

#### **Water Quality and Water Resources**

Fallow and axis deer can adversely affect water quality by, creating wide trails, destroying streamside vegetation, increasing erosion and turbidity and through increased nutrient input. Current impacts to water quality and resources from non-native deer in the park are minor to moderate (depending on the area), but continued growth and expansion of the population would result in impact intensity increasing inside the park to moderate in the long term. As the range of each species expands, the potential for moderate to major impacts outside the park becomes greater. Alternatives B and C would slightly reduce impacts inside the park, but would provide possible substantial benefits to water resources in the region by reducing the risk of the expansion of non-native deer outside the Seashore. Alternatives D and E would increase benefits in the park to moderate, and would eliminate the risk of the expansion of the population and water quality impacts to the region. No impairment (as defined relative to the Organic Act, see Chapter 1, Purpose and Need, Regulatory Background section) to park water resources would occur from implementing any alternative.

#### **Soils**

Soils would be affected by non-native deer in several ways; through direct mechanical disturbance and compaction, through erosion related to the loss of overlying vegetation, through the addition of nutrients in waste products, and by more subtle changes in soil characteristics related to physiological responses of vegetation to grazing.

Currently, more than 120 acres of park soils are impacted by fallow deer during the breeding season, which constitutes a moderate adverse impact. Expansion of the populations inside and outside the park could result in even greater (though still defined as “moderate”) adverse impacts to soils through compaction and loss. If Alternative B or C was selected, a negligible to minor short-term improvement to soils in some localized areas currently used by deer could occur compared to the No Action alternative in the first few years, although the continued presence of large herds of axis and fallow deer would result in residual impacts to nearly 100 acres of ground, e.g. long-term continued minor to moderate adverse impacts. Substantial benefits relative to Alternative A related to a reduced risk of non-native deer expanding outside the park and affecting soils regionally are likely with all action alternatives, that is, Alternatives B, C, D and E.

Moderate beneficial impacts to soils would result from adopting Alternative D or E from elimination of disturbance, compaction, erosion, and the changes to such substantial acreage from nutrient input and grazing.

No impairment of park soils would occur under any alternative.

## **Vegetation**

Deer, and other ungulates, cause a variety of impacts on vegetation. They consume vegetation, which results in changes to physical structure, structural diversity, species composition and productivity in plant communities, as well as weed and nutrient dispersal. They also trample vegetation, break branches and girdle saplings, particularly when they congregate in large groups or during the rutting season. Deer can alter patterns of nutrient cycling both within plant communities and by transferring nutrients from one community to another, and can change the distribution of nutrients between plant shoot and root structures. Depending on the soil fertility, intensity of grazing, and the vegetation being grazed, deer and other ungulates can stimulate or suppress vegetative productivity across a landscape.

Damage to riparian and understory vegetation within a large area (more than 120 acres) of the Seashore has been documented by congregating and rutting non-native deer and is currently considered moderate in intensity depending on the specific location it occurs within the park. However, this is expected to increase over time under the No Action Alternative (e.g., continuing existing management) to a moderate to locally major level because of increasing deer densities and increasing geographical scope. Impacts outside the park would be major in intensity.

Under Alternatives B and C, the impact intensity is expected to decrease slightly initially compared to No Action (some beneficial impact), but remain measurable at a moderate adverse level because of localized high deer densities over the long term. Eliminating non-native deer in Alternatives D and E would increase these benefits, especially in some locations where deer are currently in high densities (moderate to major beneficial impacts). Substantial benefits from any action alternative (B, C, D, or E) are likely relative to Alternative A from lowering the risk of non-native deer expansion outside the park and reducing impacts to vegetation regionally.

No impairment to park vegetation would occur under any alternative.

## **Wildlife**

Non-native deer can affect native wildlife by displacing them, changing habitat features and by eating the same food. Action alternatives would affect non-native deer by increasing mortality or eliminating them, and by disturbing them or changing reproduction and recruitment through contraception.

Given the projections of growth for both axis and fallow deer, these types of impacts would spread over a wider area of the park as well as outside the park in Alternative A. Pockets of extremely high non-native deer density, such as those currently seen in Olema Valley, are likely to be found increasingly throughout Marin County. Native animal species richness and diversity would decrease in those high-density areas. Dietary overlap between non-native deer and native black-tailed deer is expected to increase to the point where the Seashore black-tailed deer population would be reduced by over 60%. Overall, the magnitude of Alternative A's impacts to native wildlife within NPS boundaries is considered major in intensity, adverse and long-term. Because of their geographic scope, adverse impacts outside the boundary are also considered major in intensity.

In Alternatives B and C, fallow deer numbers would be reduced, but axis deer would grow to 350. Axis deer range is expected to increase in pastoral and natural areas of the Seashore. Although

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this expansion may benefit a few native species, it would cause a change in the abundance of native wildlife and therefore have moderate adverse impacts to wildlife inside and outside the park. Compared to an even larger axis deer range expansion expected under the No Action Alternative, Alternatives B or C would result in relative benefits for native wildlife. Native species richness and diversity would likely decrease over a smaller area than in Alternative A.

Alternatives D and E would result in a marked decrease in and eventual elimination of non-native deer. The impacts are expected to be beneficial, within NPS boundaries, to a large number of native species and adverse to a much smaller number of native species. Overall and in the long-term, the magnitude of impacts to native wildlife within and outside of NPS boundaries is considered major in intensity and beneficial.

Neither under current conditions nor under those resulting from Alternatives B, C, D and E would impairment of wildlife occur. Alternative A would result in major adverse impacts to native black-tailed deer and therefore affects a resource that is key to the natural integrity of the park or to opportunities for enjoyment of a park. As such, impairment would likely occur (see NPS 2000a, section 1.4.5).

### **Species and Habitats of Management Concern**

The federally listed species that are likely to be affected by non-native deer include northern spotted owls (*Strix occidentalis caurina*), western snowy plover (*Charadrius alexandrinus nivosus*), California red-legged frog (*Rana aurora draytonii*), Coho and Chinook salmon (*Oncorhynchus kisutch* and *Oncorhynchus tshawytscha*), steelhead trout (*Oncorhynchus mykiss*), California freshwater shrimp (*Syncaris pacifica*), and Myrtle's silverspot butterfly (*Speyeria zerene myrtleae*). No impairment to these species or other non-listed, but protected, species (see bird species of concern, below) would occur under any alternative.

#### ***Northern Spotted Owl - Threatened***

The northern spotted owl preys almost exclusively on small mammals, particularly dusky-footed wood rats in the Seashore (Chow 1998). Woodrats, in turn, are dependent on roots, stems, leaves, seeds, and mast (Linsdale and Tevis 1951; Willy 1992). Fallow deer have been recorded in areas where spotted owls nest and roost. To date, no direct effects have been noted on the productivity or survival of owls. However, deer compete with the prey species of owls, and therefore, likely have an indirect negative impact on food resources. Alternatives B and C would likely continue this impact, with continued minor, long-term adverse effects. Because of the likely beneficial impact on rodent prey base due to reduced competition for food and cover, Alternatives D and E would have a minor, long-term beneficial impact on northern spotted owls.

#### ***Western Snowy Plover – Threatened***

Western snowy plovers nest along the sandy beaches of the Seashore that are used sporadically by axis deer. A large herd of 60 axis deer has been seen on South Beach within the last five years, and where the herd occurred, the ground was heavily impacted (S. Allen, NPS, personal communication). Plovers are known to be disturbed by cattle that once roamed on Seashore beaches, and would be similarly disturbed or perhaps disrupted from nesting by the presence of non-native deer. Because this likely only occurs occasionally, the overall adverse impact of Alternative A to plovers in the Seashore is minor. Because Alternatives B and C result in higher populations of axis deer within the Seashore, such adverse impacts would increase slightly in

frequency, but would remain minor in intensity. With the elimination of axis and fallow deer under Alternatives D and E, plovers would likely experience a minor, long-term benefit.

***California Red-legged Frog - Threatened***

Fallow deer regularly frequent riparian areas where California red-legged frogs live and/or breed. They have been documented to destroy vegetation by trailing, trampling or eating plants, and by thrashing their antlers during the rut (Fellers and Osbourn 2006). Overall, the adverse impacts of Alternative A to frogs in the Seashore and in Marin County would be minor and long-term. Impacts would remain adverse, minor and long term if either Alternative B or C were implemented. A relatively minor, long-term benefit from eliminating axis and fallow deer would accrue if Alternative D or E were adopted.

***Coho Salmon, Steelhead Trout, and Chinook Salmon - Endangered and Threatened, respectively***

Coho and Chinook salmon and steelhead trout occur in many of the streams of the Seashore, particularly in Olema Creek and Lagunitas Creek. Fencing has been installed to restrict cattle from riparian areas, in part to protect other sensitive and protected wildlife. These fences, however, do not impede the movement of fallow deer. The destruction of riparian vegetation reduces cover, increases water temperature and contributes to earlier drying of streams exposed to sunlight. Overall, the adverse impacts of Alternative A to anadromous fish in the Seashore and in Marin County would be minor and long-term. This would not change if Alternative B or C were selected, but would be eliminated with relatively minor, long-term benefits under either Alternative D or E.

***California Freshwater Shrimp - Endangered***

The California freshwater shrimp inhabits lower Lagunitas Creek and lower Olema Creek, within the current fallow deer range at PRNS. Shrimp are highly dependent on overhanging riparian vegetation, under which they live year-round. Fallow deer have not been observed within known shrimp habitat. However, in other areas of both Lagunitas and Olema Creeks, high densities of fallow deer have been observed to destroy riparian vegetation (Fellers and Osbourn 2006; Brannon Ketcham, NPS, personal communication). An increase in fallow deer range, resulting from Alternative A would likely cause loss of shrimp habitat thus adversely impacting shrimp survival at all stages of the life cycle. The relative decrease in deer range under Alternatives B or C, or in density under Alternatives D or E, would not be likely to result in measurable changes to current impact levels.

***Myrtle's Silverspot Butterfly - Endangered***

Two populations of Myrtle's silverspot butterfly occur within the Seashore. The PRNS coastal dune system and coastal prairie provide critical habitat for this species. To date, it is not known whether non-native deer browse on the preferred nectar or larval host plants of the butterfly. However, research elsewhere indicates they graze on species similar to the one plant that serves as a larval host for Myrtle's silverspot butterfly at PRNS. Overall, the adverse impacts of Alternative A to Myrtle's silverspot butterfly in the Seashore and in Marin County would be moderate to major and long-term. Because the potential for increasing fallow deer range would decline while axis deer range would increase with Alternatives B and C, adverse impacts may be

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reduced to moderate and long-term. With elimination of grazing by non-native deer (in Alternatives D or E), a moderate to major relative benefit, compared to No Action, would occur.

### ***Bird Species of Concern (Not Federally Listed)***

Numerous restoration projects and fire management actions have strived to improve nesting success in land birds, particularly in riparian areas. In addition, the park is an active member of the Partner-in-Flight program, collaborating with other agencies and organizations to protect and restore populations of neotropical migratory songbirds. Destruction of riparian habitat and grazing of vegetation from ground level to a height of 2 meters by non-native deer has been documented in Olema Valley and coastal areas of the Seashore (Fellers and Osbourn 2006) and can adversely affect habitat and remove food and nesting resources used by bird species. These include not only ground or low-nesting species, but also those that nest in the forest understory. The potential impacts on reproductive success and survival are unknown. Overall, the adverse impacts of Alternative A to understory nesting songbirds of concern in the Seashore and in Marin County would be moderate to major and long-term. With fewer fallow deer, the chances of habitat destruction would be lower, and adverse impacts of Alternative B or C would be reduced compared to No Action, although residual minor to moderate adverse long-term impacts would remain. Eliminating the impact of non-native deer to understory nesting songbirds of concern in the Seashore and in Marin County by adopting Alternative D or E is beneficial, moderate to major and long-term.

### ***Plant Species of Special Concern***

Non-native deer can impact rare plant species directly by consuming, thrashing and trampling them. Fallow deer herds have been observed often in grassland, oak woodland, evergreen scrub, and Douglas fir/redwood plant communities (NPS 2001b, Fellers and Osbourn 2006), all of which can provide habitat for rare plant species. Adverse impacts to rare plants in the Seashore are currently considered to be minor and short-term. Alternative A would result in increased ranges and densities for both species and would likely lead to adverse impacts which were moderate and long-term. Alternatives B and C would result in slightly reduced deer densities compared to No Action, but would continue existing minor adverse impacts. Alternative D or E would result in minor, long-term beneficial impacts to rare plants.

### **Human Health and Safety**

Impacts to human health or safety would result from deer-vehicle collisions, the use of firearms and the use of aircraft. The risk of a deer-vehicle collision would be highest under Alternative A because the total number of non-native deer is highest. Minor benefits relative to No Action in Alternatives B and C from reductions in numbers, and minor to moderate benefits in Alternatives D and E would result from elimination. The risk to staff from firearms used to control deer would be a minor adverse impact associated with all action alternatives. The duration of this impact would be shorter in Alternatives D and E than in Alternative B or C, as culling would occur indefinitely for these latter alternatives. Additional risks to staff safety from capturing animals for administering contraceptive treatment also result from Alternatives C and E.

### **Visitor Experience**

The impacts to visitor experience would primarily involve opportunities for viewing native or non-native deer, although actions in the alternatives could also affect soundscape, visitor access,

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viewsheds and wilderness qualities. Alternative A would provide the opportunity to view both native and non-native deer; more non-native deer than action alternatives, and fewer native deer. Impacts would vary depending on the social values of the visitor, but would be negligible or minor. In addition, implementation of Alternative A would likely increase adverse impacts to wilderness character and viewshed enjoyment over time as impacts to natural resources increase. Alternatives B and C would permanently decrease the fallow deer herd, and allow axis deer to increase. Negligible to minor, long-term benefits to visitors with naturalistic or ecologicistic social values related to wildlife viewing of native ungulates, and this same level of adverse impacts to visitors with moralistic or humanistic social values would occur. Similarly Alternatives B and C would have adverse or beneficial impacts to those members of the public with anthropocentric or biocentric wilderness values, respectively. These impacts to visitors' social and wilderness values would both increase to moderate if Alternatives D or E were selected. Minor short-term adverse impacts on the visitor experience, in wilderness and other areas, from noise and deer management activities, would occur under Alternatives B and C. These may increase to moderate, short-term adverse impacts if Alternative D or E were selected. All adverse impacts of action alternatives (B, C, D and E) to wilderness character would be offset by a long-term increase in natural processes, restoration of native species and habitats, and an eventual reduction in the imprint of human manipulation.

### **Park Operations**

Park operations would continue to be affected indefinitely under Alternatives A, B or C, as perpetual monitoring would be required under all three, and perpetual management needed under B or C. Costs associated with monitoring, including purchase and operation of equipment is about 2.9% of the annual park budget. As the herd size increases and occupies land outside the park, monitoring and mitigation efforts would increase, as would the potential for litigation. This could increase costs to the park of this alternative to from 5 to 15% of the total PRNS budget over the long term, a moderate adverse impact. Although reductions and management in Alternatives B and C would initially cost more, in the long term, avoidance of litigation and lack of extensive monitoring and mitigation outside the park would likely result in a reduction in costs compared to the No Action Alternative. Costs would be about 3-6% of the park budget, a beneficial impact compared to Alternative A. These costs would continue in perpetuity. Alternative C would require additional funds to capture and research the treatment of deer with contraceptives. Because boosters and continued contraception would be required, costs would be about 3-12% of the park budget in perpetuity. Again, because deer would be much more likely to remain in the park under this alternative, costs related to monitoring, mitigation and litigation would be less than under the No Action alternative, with comparatively negligible to minor benefits to park operations. Alternative D would be the lowest cost alternative, as all non-native deer would be removed by shooting within 15 years, and no continued monitoring or management beyond that time would be required. Alternative D would require a 4.6% increase in the park budget for 15 years. Alternative E would be more expensive than Alternative D, and would require a 5-9% increase for 15 years. Because they are finite costs, both Alternative D and E offer moderate benefits to park operations compared to Alternative A.

### **Regional Economy**

Alternative A would continue existing minor adverse impacts to the regional economy indefinitely as non-native deer interfere with park ranching and grazing operations. Impacts to agricultural concerns could increase over time to a moderate, adverse level as the density of deer and the damage they cause increase. Negligible to minor, adverse socioeconomic impacts are also possible to low-income/minority farm workers should the viability of agricultural operations be

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threatened under this alternative. As the population of non-native deer expands outside the park, impacts to agricultural operations would become more widespread and, because of this larger geographic scope, could become major in intensity. Alternatives B and C would reduce the risk of the herds leaving the Seashore and affecting agricultural production, a minor long-term benefit. Alternatives D and E would eliminate any risk of the spread of these deer, a greater benefit than in Alternatives B or C, but still minor in intensity.